

# Research Summary

## Inlaid Pavement Marking Evaluation

The first objective of this evaluation was to assess IPM performance through a count of marker presence (markers that are still bonded to the pavement surface) and through a feedback survey from participants who viewed dry and wet night videos of the St. Louis area IPM sections. A further objective was to estimate the safety effectiveness of IPMs using a rigorous state-of-the-art empirical Bayes (EB) before-after analysis approach. The expected result of this study was supportive data that MoDOT needs to determine a statewide direction for the use of IPMs.

The IPM presence assessment was accomplished with the use of a vehicle mounted mobile retroreflectometer unit that can count reflective pavement markers. Unfortunately, the results of the marker presence assessment were inconclusive. The IPMs' performance did not exhibit an expected trend of increased missing marker percentages with time. The sections with the highest percentage of missing markers were only one year old, and most of the sections with the lowest percentage missing markers were two and three years old. Evaluating the same markers annually over a period of years would provide a trend of increased markers missing over the period of the study, but unfortunately evaluating different markers at different locations and of different ages at just one point in time didn't provide a performance trend. An unknown number of variables could have contributed to the varied performance of the different IPM sections. The nighttime video visibility survey, however, had more useful and expected results, and the data from the marker presence assessment allowed for additional comparisons to be made in the visibility

survey. The survey participants unanimously agree that the IPMs are more visible on wet nights than markings, and the IPMs' ability to provide guidance on lane delineation has much higher importance on a wet night than a dry night.

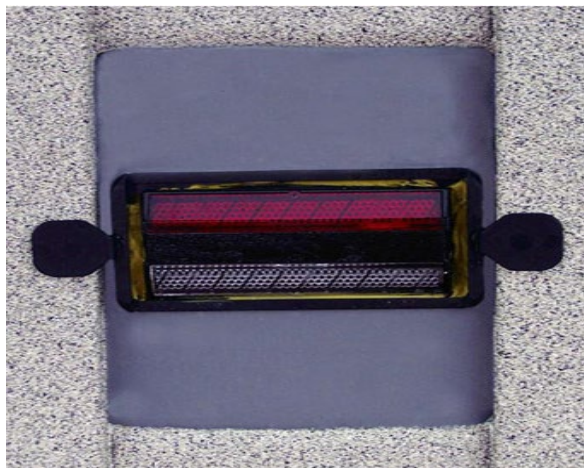
*"The expected result of this study was supportive data that MoDOT needs to determine a statewide direction for the use of IPMs."*

The participants, all of whom had no knowledge of which routes had the higher marker presence versus lower marker presence, consistently rated the visibility higher for the routes with the higher marker percentage. Also, of the four participants, the three oldest would prefer to see a minimum of three to four consecutive IPMs on a wet night, and the youngest participant would prefer to see a minimum of two consecutive IPMs on a wet night. In summary, drivers and passengers traveling on a wet night feel that IPMs are important to the visibility of the roadway's lane lines.

The IPM safety effectiveness study used data from installation sites as well as nearby reference sites for a state-of-the-art EB before-after study. The data were used to examine the effects for specific crash types, including total, fatal and injury, wet pavement, nighttime, nighttime wet pavement, lane departure, wet pavement lane departure, nighttime lane departure, and fatal and injury lane departure. Based on the aggregate results, IPMs, when installed with



pavement resurfacing, significantly reduce all crash types examined.



**Figure 1: Inlaid pavement marker**

A disaggregate analysis of the results investigated additional factors associated with the safety performance of IPMs. The results suggested that IPMs may be more effective on segments with AADT greater than 70,000 vehicles per day, three-directional lanes (compared to four directional lanes), and more expected crashes before treatment. The disaggregate analysis also sought to identify if IPMs were more effective initially with reduced effects over time, but there was no evidence supporting this.

The resulting CMFs from this effort are directly applicable to IPM installations done in coordination with pavement resurfacing and are likely to be most applicable in these cases. Additionally, the results are applicable for urban and suburban freeways with three and four directional lanes. It is unclear if the CMFs hold up for longer than three years (the limit of this analysis) so caution should be exercised in extending the analysis results beyond this time period.

### ***Project Information***

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### ***Project Manager***



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